# APPENDIX A

## GLOSSARY AND DEFINITION OF TERMS

**Many documents have been referenced to obtain the definitions of terms that are used in this document. In most cases, the definitions from the referenced documents have been used directly, while others have been modified to more fully apply to the text herein, and where appropriate, some have been developed by the authors.**

**The referenced documents are as follows:**


1. **AFETRM 127-1, Sept. 1972**
2. **MIL-STD-882, March 30, 1984**
3. **WSMCR 127-1, May 15, 1985**
4. **ESMCR 127-1, July 30, 1984**
5. **NASA GHB 1771.1, Sept. 14, 1984**
6. **Federal Register, Vol. 51, No. 38, Part 401.5**
7. **Public Law 98-575, Oct. 30, 1984**
8. **UMTA System Safety Glossary, June,1986**
9. **The Aerospace Age Dictionary, 1965**
10. **The Dictionary of Space Technology, by J.A. Angelo Jr., 1982**
11. **CPIA 394, Sept. 1984**

**ACCIDENT (MISHAP)** - An unplanned and undesirable event that results in injury; death (casualty) or damage to facilities, equipment, the launch vehicle or public property.

**ANALYSIS** - Technical procedure, following a prescribed pattern.

**ASSESSMENT** - Consideration of the results of an analysis in a broader context to determine and evaluate their significance.

**AEROZINE-50 ( A-50)** - A liquid propellant fuel; a mixture of 50% (by weight) hydrazine and 50% asymmetrical dimethylhydrazine.

**AVERAGE FAILURE RATE** - Frequency of failure averaged over the time interval of operation (or the number of duty cycles) for a component, system or subsystem.

**BLAST** - Brief and rapid movement of air or fluid away from a center of outward pressure, as in an explosion; the pressure accompanying this movement.

**CASUALTY EXPECTATION** - The probability of a casualty for a probable (or credible) accident scenario under consideration

**CREDIBLE CONDITION** - A condition that can occur and is reasonably likely to occur.

**CREDIBLE ACCIDENT** - A probable, possible and/or plausible accident scenario, or sequence of failure events which can lead to the occurrence of accidents.

**CREDIBLE FAILURE** - A failure mode which can be foreseen as possible and probable.

**CRITICAL DIAMETER** - The diameter of a confined or unconfined material below which an explosive reaction will not propagate when subjected to induced shock.

**CRITICAL FUNCTION** - As applied to nuclear and space launch systems, those functions which apply directly to, or control, mission success or failure (e.g., functions that enable, pre-arm, arm, unlock, release or guide).

**CRYOGEN** - A liquid which boils at temperatures of less than about 114°K (- 254.4°F) at atmospheric pressure, e.g., hydrogen, helium, nitrogen, oxygen, air or methane.

**DAMAGE** - A loss, negative outcome or undesirable impact of an accident. May refer to equipment, property, monetary or production loss.

**DEFLAGRATE** - Burn at a rapid rate, but below the speed of sound in the unreacted medium.

**DELPHI ANALYSIS -** A method of risk assessment which requires experts' opinions and consensus-building; term derives from the ancient Greek Delphi oracle which could predict the future.

**DETONATION** - An exothermic reaction that propagates with such speed that the rate of advance of the reaction zone into the unreacted material exceeds the velocity of sound in the unreacted material. The rate of advance of the reaction zone is termed detonation velocity. When this rate of advance attains a value that will continue without diminution through the unreacted material, it is termed the stable detonation velocity. When the detonation velocity is equal to or greater than the stable detonation velocity of the explosive, the reaction is termed a "high order" detonation. When it is lower, the reaction is termed a "low order" detonation.

**DEVIATION** - An alternate method of compliance with the intent of satisfying specific requirements. A procedure differing from established norms and practices.

**DYNAMIC PRESSURE** - The air pressure which results from the mass air flow (or wind) behind the shock front of a blast wave. It is equal to the product of half the density of the air through which the blast wave passed and the square of the particle (or wind) velocity behind the shock front as it impinges on the object or structure.

**EQUIVALENT WEIGHT (EW)** - The amount of a standard explosive which, when detonated, will produce a blast effect comparable to that which results at the same distance from the detonation or explosion of a given amount of material whose performance is being evaluated. It is usually expressed as a percentage of the total weight of all reactive materials contained in the item or system. It is conventional to use TNT for comparison.

**EVENT** - A specific occurrence that is defined by a time and location.

**EXPECTED LOSS** - The probable loss or damage/casualty level for the accident scenario under consideration.

**EXPENDABLE LAUNCH VEHICLE (ELV)** - A launch vehicle (configuration of rocket motors) intended to be used only once, because the majority of its components are expected to be destroyed or discarded after the launch, during orbit insertion and/or re-entry.

**EXPLOSION** - A rapid expansion of matter into a volume greater than its original one, accompanied (in air) by loud sounds.

**EXPLOSIVE** - Any chemical compound or mechanical mixture which, when subjected to heat, impact, friction, detonation or other suitable initiation, undergoes a very rapid chemical change with the production of large volumes of highly heated gases which exert pressures in the surrounding medium. The term applies to materials that either detonate or deflagrate.

**FAILURE -** A condition of a component, subsystem or system in which the intended design or specified operation is not met.

**FAILURE ANALYSIS** - The process by which the cause, effect, responsibility and cost of an accident is determined and reported. A method to identify the types of faults or malfunctions that may occur and lead to accidents.

**FAILURE MODE** - A specific failure for a critical component, subsystem or system which can be foreseen or identified .

**FAILURE MODE AND EFFECT ANALYSIS (FMEA)** - An inductive procedure in which potential malfunctions are identified and then analyzed as to their possible effects.

**FAULT TREE ANALYSIS (FTA)** - A deductive analysis procedure which graphically presents all possible sequences of failures and chains of events which can result in the final undesired event (accident) at the top of the tree; used to determine possible and most probable causes.

**FIREBALL** - A more or less spherical ball of flames produced by the instantaneous release, evaporation and ignition of propellants. Generally, the fireball expands and rises in the atmosphere until the propellant is consumed.

**FIREBRAND** - A projected burning or hot fragment whose thermal energy is transferred to a receptor.

**FLAMMABLE LIMITS** - The upper and lower vapor concentrations of fuel to air which will ignite and burn (i.e., deflagrate) in the presence of external ignition sources; often referred to as the explosive range, although they are not identical.

**FLASH EVAPORATION** - The changing of a liquid propellant into a gas when the external pressure is released during the rupture of a vessel.

**FLIGHT** - That period of time beginning with engine ignition and continuing until earth impact for suborbital or orbital trajectories, or indefinitely for deep space trajectories.

**FLIGHT AZIMUTH** - The angular direction of the launch and flight trajectory of a launch vehicle measured in degrees from true north.

**FLIGHT CORRIDOR** - Two-dimensional area on Earth's surface (ground track) above which a launch vehicle can fly safely.

**FLIGHT PATH** - The path traversed through the atmosphere or through space by a launch vehicle or spacecraft.

**FLIGHT PLAN** - Description of the proposed launch and its events, including description and definition of payload orbit.

**FLIGHT SAFETY** - Protection of the public health and safety and safety of property during the flight of the launch vehicle and its payload.

**FLIGHT TERMINATION SYSTEM (FTS)** - Explosive or other disabling equipment installed in the ELV stages plus associated ground equipment for tracking and terminating the flight should it become necessary in order to protect people and property on the ground from a malfunctioning ELV. Also called Flight Safety Control System. A Thrust Termination System is a special type of FTS which shuts down the propulsion system.

**GEO** - Geosynchronous or Geostationary Earth orbit; equatorial, high altitude Earth orbits in which a satellite rotates with Earth's spin period, thus appearing stationary with respect to its sub-Earth point.

**GROUND TRACK** - The projection of a spacecraft launch, flight and orbital trajectory onto the surface of the Earth, traced by the motion of its sub- Earth point.

**HAZARD** - Any existing or potential condition that can cause injury or death, that leads to risk of damage to or loss of equipment or property. Also; A source of potential damage or harm, in case of an accident.

**HAZARD ANALYSIS** - An analysis performed to identify hazardous conditions for the purpose of their elimination or control.

**HAZARD MANAGEMENT** - An element of the system safety management function that evaluates the safety effects of potential hazards by considering acceptance, control or elimination of such hazards.

**HAZARDOUS CONDITION** - A situation where, because of the nature of the equipment, facilities, personnel, environment or operation being performed, there is a potential for an accident. For example, hazardous conditions may exist:
1. During propellant transfer to or from the ELV, whenever work is in progress on a rocket containing propellant and whenever a solid propellant motor is in a propulsive state.
2. During installation, electrical connection, testing and handling of ordinance items also, while ordinance items are electrically connected in the missile.
3. Whenever vehicle pressurization systems fail to satisfy safety factors.
4. Whenever any toxic or flammable materials are used for any purpose in ELV handling areas.
5. Any time that electrical storms are within five miles of the launch complex.

**HAZARDOUS EVENT** - An accidental occurrence that endangers people or property

**HAZARDOUS EVENT PROBABILITY** - The likelihood, expressed in quantitative terms, that a hazardous event will occur. Both units of frequency, (1/ time) and probability (dimensionless), can be used. See also next entry.

**HAZARD PROBABILITY** - The probability that a hazard will occur during the planned life or operation of the system. Hazard probability may also be expressed in qualitative terms using a relative ranking system, such as:

A. Frequent
B. Probable
C. Occasional
D. Remote
E. Improbable
F. Impossible

**HAZARD SEVERITY** - A qualitative measure of the potential consequences that could be caused by a specific hazard in case of an accident. An example of a hazard severity ranking system is:

A. Catastrophic
B. Critical
C. Marginal
D. Negligible

**HYPERGOLIC** - Term applied to the self ignition of a fuel and an oxidizer upon mixing with each other without a spark or other external aid.

**IGNITION TEMPERATURE** - The mean temperature at which a combustible material can be ignited and will continue to burn when the ignition source is removed.
The ignition temperature for any one substance will vary with its particle size, confinement, moisture content and ambient temperature.

**IMPACT AREA** - An area surrounding an approved impact point for vehicle stages under normal operation or for destructed vehicle debris. The extent and configuration of the area is based upon the vehicle or stage dispersion characteristics.

**IMPACT LIMIT LINE** - A predetermined line defining a limit beyond which a failed ELV or its jettisoned spent stages will not be allowed to impact on the ground, in order to protect people or property.

**IMPULSE** - Blast wave parameter denoting the integral of pressure over pulse duration. It may be positive or negative depending on whether the pressure is above or below ambient.

**LAUNCH** - Release a powered rocket/spacecraft from a specially designed launch pad or platform.

**LAUNCH ABORT** - Premature and abrupt termination of a launch operation because of a potential or diagnosed failure of the launch system or noncompliance with the launch safety requirements.

**LAUNCH ACTIVITY** - The preparation, test or execution of launch; the operation of a launch site or both.

**LAUNCH AZIMUTH** - The horizontal angular direction initially taken by a launch vehicle at lift-off, measured clockwise in degrees from true north (see flight azimuth).

**LAUNCH COMPLEX** - The facility, usually fenced, which contains the ELV launch facilities including: the launch pad and servicing structures, the blockhouse or control building, propellant transfer equipment, support buildings (e.g., vehicle assembly building, VAB) required to support a launch.

**LAUNCH CONTROL CENTER (LCC)** - The facility from which launch operations are conducted and monitored.

**LAUNCH CONTROL OFFICER** - The individual who supervises and coordinates activities in the launch complex during prelaunch and post-launch. Also called Range Safety Officer (RSO).

**LAUNCH OPERATION** - Site, personnel, procedures, equipment and vehicles, which are collectively used for launch preparation or launch of a launch vehicle.

**LAUNCH PROPERTY** - Propellants, launch vehicles and components thereof and other physical items constructed for, or used in, the preparation or launch of a launch vehicle.

**LAUNCH RANGE** - A finite area along the path of a launch vehicle beginning at a launch site and ending at a point where the vehicle impacts on Earth, achieves orbit or reaches escape velocity. Includes instrumentation throughout that area used to monitor the flight of the launch vehicle for safety and other purposes.

**LAUNCH SAFETY** - Protection of personnel, safety of property on the ground and of the public health and safety during and after a launch operation.

**LAUNCH SERVICES** - Activities involved in the preparation of a launch vehicle and its payload (including assembly, test, integration and environmental protection) for launch and the conduct of a launch.

**LAUNCH SITE** - The geographical location from which a launch takes place, as defined in any license issued or transferred by DOT. Includes all facilities located on a launch site which are necessary to conduct a launch. See also Launch Complex.

**LAUNCH SITE OPERATOR** - A sponsoring or contractor organization (government or commercial) which has the demonstrated capability to satisfactorily conduct a launch operation safely from a particular launch site.

**LAUNCH VEHICLE** - Any rocket propulsion or similarly capable vehicle constructed for the purpose of inserting a payload in a ballistic or orbital trajectory.

**LICENSEE** - The person or organization authorized by a license to conduct specified commercial launch activities and who is responsible for conducting such activities in conformance with applicable DOT regulatory requirements.

**LIQUEFIED GASES** - Substances which are gases at ambient conditions of temperature and pressure that have been converted to liquids under controlled pressure and temperature.

**LOW EARTH ORBIT (LEO)** - Orbital altitudes up to about 1,000 km. (see Ch. 6, Vol.2).

**LOWER FLAMMABLE LIMIT (LFL)** - The lowest concentration, by percent of volume, of a gas or vapor in the atmosphere at normal temperatures and pressures at which the gas or vapor will ignite and sustain combustion.

**MISHAP** - An unplanned event or series of undesirable events that result in death, injury, damage or loss of equipment and/or property. (See also ACCIDENT)

**MISSION** - The objective to be accomplished by a proposed launch and the general plan for achieving that objective, namely launch azimuth, site, orbital parameters, vehicle configuration, design, etc.

**ORBIT INCLINATION** - The angle between the plane of a particular orbit and the equator.

**ORBITAL INJECTION** - The sequence of operations, in time and space, whereby a vehicle achieves a combination of velocity and position so that its payload is placed into the desired Earth orbit.

**ORBITAL VELOCITY** - The velocity at which the centrifugal force created by the launch vehicle's motion around the Earth equals the Earth's gravity; at this point the vehicle will orbit the Earth until some other force is applied.

**OBLATENESS** - The deviation of the Earth's shape from a perfect sphere (flattened poles, bulging equator).

**OVERPRESSURE** - Blast wave parameter denoting the peak pressure rise over ambient.

**PASCAL** - Unit of pressure. 1kPa = 1000 Pa. 1 atmosphere = 101 kPa

**POOL FIRE** - A fuel film formed on the ground and burning in a turbulent diffusion flame located above the film.

**PRELIMINARY HAZARD ANALYSIS (PHA)** - A qualitative listing and ranking of hazards of interest.

**PROPELLANTS** - Balanced mixtures of fuel and oxidizer designed to produce large volumes of hot gases at controlled, predetermined rates, once the burning reaction is initiated.

**PSI** - Pounds per square inch, a unit of pressure. 1 atmosphere = 14.7 psi.

**RESIDUAL RISK** - Risk exposure levels which cannot be further reduced or eliminated by risk mitigation (management) strategies and must be accepted.

**RISK** - The potential for an undesirable consequence to arise from an accident occurring during a hazardous activity. Technically, Risk (R) is the product of the probability (p) or frequency (f) of occurrence and its consequence (C) (the severity of its impact).

**RISK ANALYSIS** - A detailed examination of systems and operations which involves both the estimation of the expected frequency or probability of adverse events and the severity (magnitude) of their consequence expressed in units of interest (property damage, casualties, down time, production or business losses). Risk analysis requires; first the identification and characterization of hazards (qualitative analysis); then a quantification and ranking of hazards in terms of the likelihood of their occurrence, severity of their consequence or their expected risk figure.

**RISK ASSESSMENT**- Evaluation of analytical results of Risk Analysis in a broader context.

**RISK SCREENING** - The ordered ranking of hazards so that acceptable risk thresholds can be defined and intolerable risk levels that require reduction and management resources can be identified.

**RISK MANAGEMENT** - The process used to form decisions that control risk (reduce, eliminate or accept) based on system safety analysis. The set of policy and operational control options that must be introduced in order to avoid, reduce and eliminate risks. Risk management may focus on either prevention and diminished probability of occurrence of hazardous events or on controlling the impacts of such events by emergency preparedness and response planning. Risk management options are usually selected based on cost-benefit analyses.

**SAFETY ASSESSMENT REPORT (SAR)** - A comprehensive evaluation of the safety risks being assumed prior to test or operation of the system. It identifies all safety features of the system, as well as the design and procedural hazards present and specific controls to be adopted.

**SAFETY** - A reasonable degree of freedom from those conditions that can cause injury, death to personnel, damage or loss of equipment or property; freedom from danger.

**SAFETY CRITICAL** - A designation placed on a system, subsystem, element, component, device or function denoting that satisfactory operation of such is mandatory to ensure a safe operation. Such a designation dictates incorporation of special safety design considerations and features. Any condition, event, operation, process, equipment or system with a potential for major injury or damage.

**SAFETY OPERATIONS** - Collectively the personnel, equipment, facilities, documented plans, procedures and any other resource needed for safe preparation and launch of a launch vehicle and its payload.

**SHOCK WAVE** - A relatively thin region of discontinuity which can propagate through fluids and solids and across which properties (pressure, velocity, density and temperature) change very rapidly.

**SOLID PROPELLANTS** - Solid propellants act as monopropellants. Homogeneous propellants are true solid monopropellants; each molecule contains both fuel and oxygen (e.g., nitrocellulose-containing compounds). Composite propellants are physical (not chemical) mixtures of a finely ground oxidizer in a matrix of plastic, resinous or elastomeric fuel (e.g., ammonium perchlorate in a resin binder).

**SYSTEM** - A composite, at any level of complexity, of personnel, procedures, materials, tools, equipment, facilities and software. The elements of this composite entity are used together in the intended operational or support environment to perform a given task or achieve a specific production, support or mission requirement.

**SYSTEM SAFETY** - The application of engineering and management principles, criteria and techniques to optimize safety within the constraints of operational effectiveness, time and cost throughout all phases of the system life cycle.

**SYSTEM SAFETY MANAGEMENT** - The element that defines the system safety program requirements and ensures the planning, implementation and accomplishment of system safety tasks and activities.

**SUBORBITAL LAUNCH** - A launch during which the vehicle does not achieve orbital velocity and, therefore, falls back to the Earth's surface following a ballistic trajectory after the completion of powered flight.

**SUBORBITAL TRAJECTORY** - The ballistic path a launch vehicle follows during a suborbital launch.

**THERMAL RADIATION** - Thermal energy emitted by hot surfaces or gases by virtue of their temperatures.

**THRESHOLD LIMIT VALUE (TLV)** - The lowest concentration level of a toxic substance at which toxic effects may develop.

**TNT EQUIVALENT YIELD** - Energy release in an explosion inferred from measurements of the characteristics of blast waves generated by the explosion.

**TRAJECTORY** - A series of points in three dimensional space relative to time that describes the exact position of the vehicle at any time with respect to Earth's surface.

**UPPER FLAMMABLE LIMIT (UFL)** - The highest concentration, by percent of volume, of a gas or vapor in the atmosphere at normal temperatures and pressures at which the gas or vapor will ignite and sustain combustion.

**VOLATILE** - A substance that has a high vapor pressure (i.e., it will readily vaporize) at a low temperature.